APPENDIX A

IN THE SPECIFICATION

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An original image is read by an image input means 10 formed of CCD elements etc. On the original image, lossy compression (non-reversible compression) by the JPEG is carried out by compression means 3900 **In JPEG, Lossless compression and Lossy compression standard are proposed. Lossless compression is defined as the reversible compression the original image can be recovered when the compression image is expanded, and Lossy compression is defined as the non-reversible compression the original image can not be recovered when the compressed image is expanded. Fig. 39 shows the example of block diagram in case of Lossy compression.**

That is, discrete cosine transform of the original image is performed by discrete cosine transform (DCT) means 3906 whereby the original image is transformed into signals in the frequency space, and the obtained transform coefficient is quantized by quantization means 3907 using a quantization table 3901. The results of this quantization are transformed into a code string by entropy encoding means 3908 on the basis of an entropy encoding table 3902, and this code string is stored on a storage medium 15. This processing is continued until after the compression of all the original images is over. In this connection, a lossless compression (reversible compression) method in which an image can be restored without distortion is also proposed for the JPEG standard. When the lossress compression is used, the compression ratio, which is defined as the ratio of original image size to the compressed image size, is very low. Therfore, lossy compression is generally used. But when lossy compression is used, the original image are not exactly reconstructed because of the quantization error as in FIG. 39 and the rounding error by DCT. Of the two reversible factors, the quantization error has bad influence on the quality of the reconstructed image especially.

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It is possible for Reduced Images (RI) generating means 101 to extract the frequency area corresponding to a specified size (preview size, for example) from the low frequency components **obtained by LFC extracting means 100** and to generate a reduced image by performing inverse orthogonal transformation on that components.

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In FIG. 1, the processing steps by image input means 10 and OI orthogonal transforming means 11 for orthogonal transform of original images are the same as those in Embodiment 1 and will not be described. LFC extracting means 100 extracts low frequency components according to the number of picture elements of Reduced Images (RI) display means 102 that displays thumbnail images. RI generating means 101 performs inverse orthogonal transform on the low frequency components **extracted by the LFC extracting means 100**, and thumbnail images are displayed on RI display means 102.

IN THE CLAIMS:

48. The image processing device of claim 46 wherein said Enlarging Object Images means comprising:

Edge generating means for generating edge images – in a plurality of specific directions – of an image regulated by said Inputted Images regulating means, and

Leveling up means for generating an image having four times as many picture elements by regarding said respective edge images and said regulated original image as sub-band components in Wavelet transform and by performing inverse Wavelet transform on said sub-band components.

50. The image processing device of claim 46 wherein said Enlarging Object Images initializing means comprising:

Input fine-adjustment means for re-regulating the numbers of the picture elements of said regulated original image in the horizontal direction and the vertical direction to multiples of 2,

Leveling down means for generating a transformed image by performing Wavelet transform on said re-regulated original image,

Reference Components generating means for generating edge images – in a plurality of said specific directions – from a plurality of sub-band components situated in the of said transformed image,

Correction estimating means for finding the relation between said respective edge images and the sub-band components belonging to the low frequency area corresponding to said specific directions of said transformed images,

Edge generating means for generating edge image – in plurality of specific direction – of image re-regulated be said Input fine-adjustment means,

Component estimating means for estimating the respective sub-band components in Wavelet transform by correcting said respective edge image of re-regulated original image according to the results of said correction estimating means, and

Leveling up means for generating an enlarged image having four times as many picture elements by performing inverse Wavelet transform on said respective sub-band components and said re-regulated original image.

51. The image processing device of claim 50 wherein Reference Components generating means finds said edge image by Laplacian filter from the sub-band components situated in the low frequency area of said transformed image.

52. The image processing device of claim 50 wherein Reference Components generating means finds said edge extraction filters corresponding to respective direction from the sub-band components situated in the low frequency area of said transformed image.

53. The image processing device of claim 46 wherein in case said Ln/2 picture elements and Lm/2 picture elements are integers, an inputted original image is regulated by said Inputted Images regulating means, and from the regulated image, said Enlarging Object Images means generates an enlarged image, and wherein in case at least one of Ln/2 picture elements and Lm/2 picture elements is not an integer, these numbers are changed so that both may become integer, the inputted original image is regulated at the image composed of these numbers of picture elements by said Inputted Images regulating means, and from the regulated image, said Enlarging Object Images means generates an enlarged image, and then the enlarged image obtained by Enlarging Object Images means is regulated to Ln picture elements x Lm picture elements by Enlarged Image regulating means.

54. The image processing device of claim 50 wherein said correction estimating means finds the difference image – as respective correction component image – between the edge images in said respective directions and the sub-band components belonging to the low frequency area corresponding to said specific directions of said transformed images, and wherein said component estimating means enlarges said respective correction component images to images with four times as many picture elements by liner interpolation, and adds the corresponding edge images to said correction component images.

55. An image processing device for acquiring an enlarged image of Ln picture elements x Lm picture elements by enlarging a color image of n picture elements x m picture elements, said device comprising:

Standard Component selecting means for selecting a standard color component from among the components making up said color image,

Transform Ratio deriving means for deriving the transform ratio which is used when deriving the other color components from the standard color selected by said Standard Component selecting means,

Standard Component Image regulating means for regulating the standard color component of the inputted original image to Ln/2 picture elements x Lm/2 picture elements,

Standard Image enlarging means for generating a standard enlarged image by applying a method based on Wavelet transform to said regulated standard color component,

Standard Enlarged Image regulating means for regulating said standard enlarged image to a desired size Ln picture elements x Lm pictures elements,

Shortage Component enlarging means for estimating the enlarged images of the other color components by applying said transform ratio to said regulated standard enlarged image, and

Enlarged Color Image recomposing means for generating said enlarged image by synthesizing said standard enlarged image and said enlarged images of the other color components.

56. An image processing method for acquiring an enlarged image of Ln picture elements x Lm picture elements by enlarging an original image of n picture elements x m picture elements, said method comprising the steps of:

inputted image regulating for regulating said original image Ln/2 picture elements x Lm/2 picture elements, and

image enlargement for generating an enlarged image by applying an enlargement method based on Wavelet transform to the image regulated by Inputted Images regulating means.

57. An image processing method for acquiring an enlarged image by enlarging an original image, said method comprising the steps of :

enlargement initializing for initializing the enlargement process by setting the original image as enlargement object image,

object image enlarging for generating an enlarged image having four times as many picture elements by applying an enlargement method based on Wavelet transform to said enlargement object image,

multiple proceeding end judging for setting- as enlargement object image-the enlarged image obtained by said Enlarging Object Images means and returns the process to said Enlarging Object Images means,

image regulating for enlarging or reducing the enlarged image presented by said Enlarging Object Images means, and

enlarged image outputting for outputting the image obtained from said image fine-adjustment means.

58. A recorded medium on which a program is recorded, said program – when acquiring an enlarged image of Ln picture elements x Lm picture elements by enlarging a color image of n picture elements x m picture elements- regulating said original image Ln/2 picture elements x Lm/2 picture elements, and applying an enlargement method based on Wavelet transform to the regulated image, thereby generating an enlarged image.

59. A recorded medium on which a program is recorded, said program-when acquiring an enlarged image by regulating an original image- setting the original image as enlargement object image, and generating an enlarged image having four times as many picture elements by applying an enlargement method based on Wavelet transform to said enlargement object image, setting the enlarged image as enlargement object image and returning the process to Enlarging Object Images means and at the same time visually presenting the enlarged image, thereby enlarging or reducing said enlarged image.

60. The image processing device of claim 46 wherein said Enlarging Object Images means comprising:

Edge generating means for generating edge images – in a plurality of specific directions – of an image regulated by said Inputted Images regulating means, and

Leveling up means for generating an image having four times as many picture elements by regarding said respective edge images and said regulated original image as sub-band components in Wavelet transform and by performing inverse Wavelet transform on said sub-band components.

61. The image processing device of claim 46 wherein said Enlarging Object Images initializing means comprising:

Input fine-adjustment means for re-regulating the numbers of the picture elements of said regulated original image in the horizontal direction and the vertical direction to multiples of 2,

Leveling down means for generating a transformed image by performing Wavelet transform on said re-regulated original image,

Reference Components generating means for generating edge images – in a plurality of said specific directions – from a plurality of sub-band components situated in the of said transformed image,

Correction estimating means for finding the relation between said respective edge images and the sub-band components belonging to the low frequency [space] area corresponding to said specific directions of said transformed images,

Edge generating means for generating edge image – in plurality of specific direction – of image re-regulated be said Input fine-adjustment means,

Component estimating means for estimating the respective sub-band components in Wavelet transform by correcting said respective edge image of re-regulated original image according to the results of said correction estimating means, and

Leveling up means for generating an enlarged image having four times as many picture elements by performing inverse Wavelet transform on said respective sub-band components and said re-regulated original image.

62. The image processing device of claim 50 wherein Reference Components generating means finds said edge extraction filters corresponding to respective direction from the sub-band components situated in the low frequency area of said transformed image.